

## Component 4: Introduction to Information and Computer Science

### Unit 7: Networks & Networking (Part 1 of 5)

---

---

---

---

---

---

---

---

### Unit Objectives

- Understand the history of networks and their evolution.
- List and describe the various types of network communications.
- List and describe the various forms of network addressing, including DNS.
- List and define the different types of networks.
- Describe different network topologies.
- List and describe different network standards and protocols.
- Describe wireless communication.
- List and describe network hardware.
- Explain networking logical model concepts.

Component 4/Unit 7a

Health IT Workforce Curriculum  
Version 1.0/Fall 2010

2

---

---

---

---

---

---

---

---

### What is a Network?

- According to Wikipedia, a network is:
  - "...a collection of computers and devices connected by communications channels that facilitates communications among users and allows users to share resources with other users."
- In English please...
  - A network is made up of computers, printers, other devices, and some sort of media (cabling, wireless) that allows all of these devices to communicate with each other.

Component 4/Unit 7a

Health IT Workforce Curriculum  
Version 1.0/Fall 2010

3

---

---

---

---

---

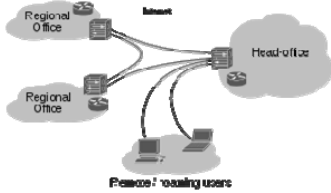
---

---

---

## Modern Network Example

- A site-to-site network with support for remote users.



[http://en.wikipedia.org/wiki/File:Virtual\\_Private\\_Network\\_overview.svg](http://en.wikipedia.org/wiki/File:Virtual_Private_Network_overview.svg)

---

---

---

---

---

---

---

---

## Why Networks?

- Share hardware –
  - Printer, scanner, data storage devices.
- Share software –
  - Software installed on a server to reduce cost.
- Share files –
  - Images, spreadsheets, documents.
- Communicate –
  - E-mail, network phones, live chat, instant messaging.

---

---

---

---

---

---

---

---

## Networks Decrease Cost

- Printed documentation moved to a Web server.
  - No longer need to update physically. Can update Web page and notify users of changes.
- E-mail done electronically and replaces paper documents.
- Easier to keep device software current.
  - No need to physically visit each device to manage it or upgrade software.

---

---

---

---

---

---

---

---

### Networks Serve Customers

- Documentation can be posted online in Web pages and kept current by changing one document.
- Customers can chat or e-mail with customer service reps.
- Customer service reps have access to a common network database containing solutions to common customer requests or issues.

---

---

---

---

---

---

---

---

### Networks Serve Customers (cont'd)

- Hospitals can store all patient data in one common network database, improving quality of care.
- Medical staff and patients can access electronic medical records stored in a network database.

---

---

---

---

---

---

---

---

### How Devices Connect to a Network

- Wired or wireless connections.
- Network may be connected to the Internet.
  - An Internet connection requires the use of an ISP.
  - An intranet connection does not connect a device to the Internet.
    - However, it may connect various offices together, regardless of their location (Chicago to Portland) and not provide Internet access.

---

---

---

---

---

---

---

---

## Wired vs. Wireless Networks

- **Wired connections:**
  - Require NIC, copper cables, switch, router.
  - Home routers also contain switch ports.
- **Wireless connections:**
  - Require wireless NIC, WAP, switch, router.
  - Most routers contain a few switch ports.
- **Fiber connections:**
  - Require fiber NIC, fiber optic cables, switch, router.
  - Most routers and switches do NOT contain fiber ports and they can be costly to purchase.

Component 4/Unit 7a

Health IT Workforce Curriculum  
Version 1.0/Fall 2010

10

---

---

---

---

---

---

---

---

## It's All About Speed

- Networks measure speed using the terms **bandwidth** and **throughput**.
  - Bandwidth is the highest number of bits that can be sent at any one time.
  - Throughput is the amount of bandwidth you can use for actual network communications.
- **Example:**
  - Bandwidth on your cabled network is 100 Mbps.
  - Because of physical limitations and other required network traffic, throughput is usually approx. 70 Mbps.

Component 4/Unit 7a

Health IT Workforce Curriculum  
Version 1.0/Fall 2010

11

---

---

---

---

---

---

---

---

## It's All About Speed (cont'd)

- **Speed is influenced by the network media:**
  - Copper wire speed is commonly 100/1,000 Mbps.
  - Wireless speed is commonly 54 Mbps.
    - The 'Draft N' standard offers approx. 200 Mbps speed!
  - Fiber optic cable offers the same speeds as copper wiring but can travel longer distances.

Left: LC/PC connectors.  
Right: SC/PC connectors.  
All four connectors have white caps covering the ferrules.



Copper wiring with RJ-45 jack at end.



Component 4/Unit 7a

Health IT Workforce Curriculum  
Version 1.0/Fall 2010

12

---

---

---

---

---

---

---

---

### Service Providers and You

- Internet Access Providers connect users to the Internet.
  - ✓ Access to the Internet revolves around the use of ISPs.
  - ✓ ISPs are organized as local, regional, and national providers.



---

---

---

---

---

---

---

---

### Connecting to the Internet

- Devices commonly connect to the Internet via dialup, broadband, Wi-Fi, satellite, and 3G.
  - ✓ Dialup – copper phone lines to connect to an ISP's modem. Limited to a speed of 56 Kbps.
    - The slowest connection type!
  - ✓ Broadband – higher quality copper phone lines, coaxial cable, or fiber optic connection type.
    - Faster than dialup and in the approximate range of 768 Kbps and higher.

---

---

---

---

---

---

---

---

### Connecting to the Internet (cont'd)

- Wi-Fi – wireless (radio frequency) connection type.
  - ✓ Wi-Fi refers to the IEEE 802.11 standard governing wireless technologies.
  - ✓ Typically used to connect laptops to WAPs. The WAP is connected to the wired network to gain access to the Internet.
  - ✓ Also used extensively by hotels and airports.
  - ✓ Wireless speeds range from 1 Mbps to 200+ Mbps, depending on a variety of factors.

---

---

---

---

---

---

---

---

### Connecting to the Internet (cont'd)

- Satellite – Connection to a ground satellite dish (antennae) and the satellite relays signals to a satellite orbiting the earth. Then the orbiting satellite relays the signal to another ground satellite dish.
  - ✓ Can be somewhat slow because of the time it takes to make a round trip. The loss of speed is known as "latency."
- 3G – The 3rd Generation of standards governing mobile telecommunications.
  - ✓ Speed ranges from 2 Mbps – 5 Mbps, depending on plan and location.

---

---

---

---

---

---

---

---

### Leasing an IP Address

- ISPs lease IP addresses to subscribers.
  - ✓ Your private (home or business) network usually utilizes private IP addressing.
  - ✓ The ISP typically leases your location one public IP address.
  - ✓ The ISPs equipment is provided with a public IP address to connect to the ISPs public network.
  - ✓ The ISPs equipment is also provided with a private IP address to connect to your private network.

---

---

---

---

---

---

---

---

### Leasing a Dynamic IP Address

- The ISPs equipment is able to translate addressing between the private and public networks.
- ISPs generally provide you with an IP address that may change from day to day.
  - ✓ This is a typical leased, dynamic IP address and is included in the monthly fee.

---

---

---

---

---

---

---

---

### Leasing a Static IP Address

- ISPs can also lease an IP address for the duration of the contract.
  - ✓ The static IP address will not change.
- Most Web sites use static IP addresses so that their domain name will be reliably mapped to one IP address.
- ISPs charge more each month for static IP address. The charge ranges from \$5 to \$100, depending on provider.

---

---

---

---

---

---

---

---